

Diversity and Species Richness of Butterflies and Skippers in Central Spain Habitats

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Abstract. Local species number and diversity of butterflies from the more common habitat types in the Tagus Valley of central Spain are presented. Butterfly faunas are richest in less disturbed, better preserved shrublands with accompanying forest, particularly in "quejigares" forest dominated by the mediterranean oak *Quercus faginea*.

Introduction

The complexity of herbivorous insect communities generally reflects the diversity of the habitats or communities in which they occur (recently Strong & Levin, 1979; Templado, 1982; Lawton, 1983, among others). This observation has been considered in analyzing the butterfly and skipper faunas from major vegetational communities in the Tagus Valley of central Spain. The objective of this study is to compare butterfly diversity from a variety of habitats and to assess their relative conservation value since species number and diversity are the criteria most commonly used to assess wildlife conservation potential of habitats (Margules & Usher, 1981).

Material and Methods

The study area is 6000 sq. km located in the center of the Iberian Peninsula, between the Sistema Central Mountains and the Tagus River (Fig. 1).

This is a flat region. The substrate is mainly sedimentary; sands (Northwestern portion) and calcareous and chalky rocks (Southwestern, Southern and Eastern portions). All of the geological formations in this region are Miocene.

The Tagus Valley climax vegetation consists of evergreen *Quercus rotundifolia* and mediterranean oak (*Quercus faginea*) forests (Rivas Martinez, 1982). But well-preserved forests are rare. When these forests are altered, in the usual course of events, by human disturbance, a chaparral succeeds and *Quercus coccifera* shrubs dominate. When chaparral is also eliminated, an "esparto" grassland will occur (see Fig. 2). The dominant floral elements in these and the other major natural

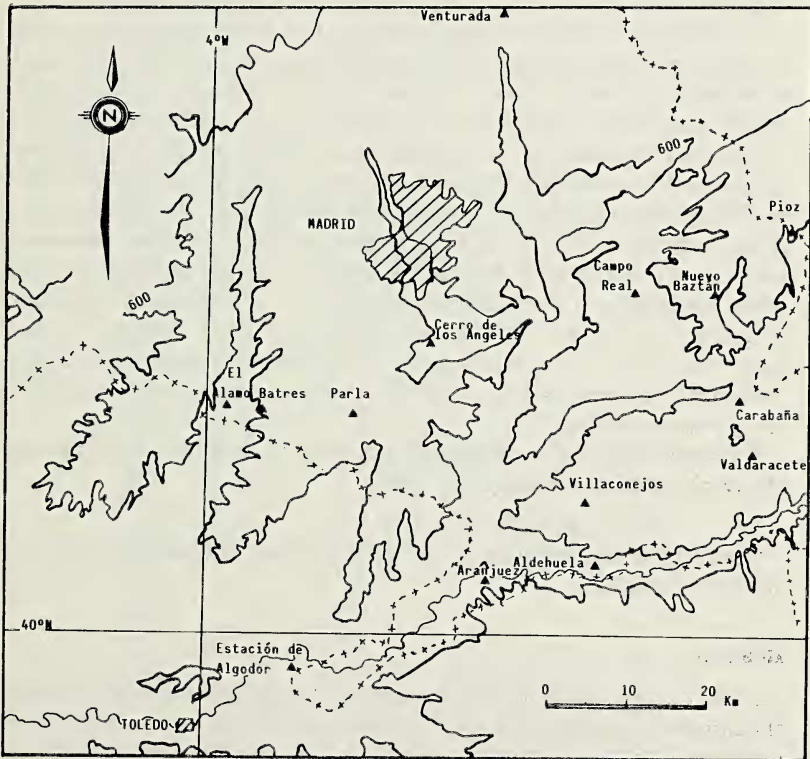
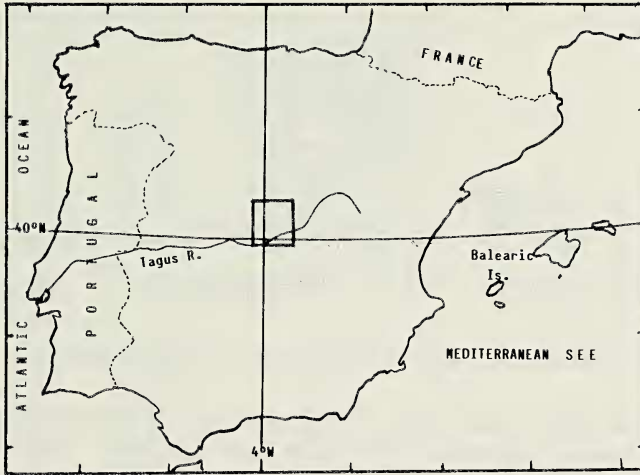


Fig. 1. Maps showing the location of the area in Spain (above) and the localities in the area (Tagus Valley, below).

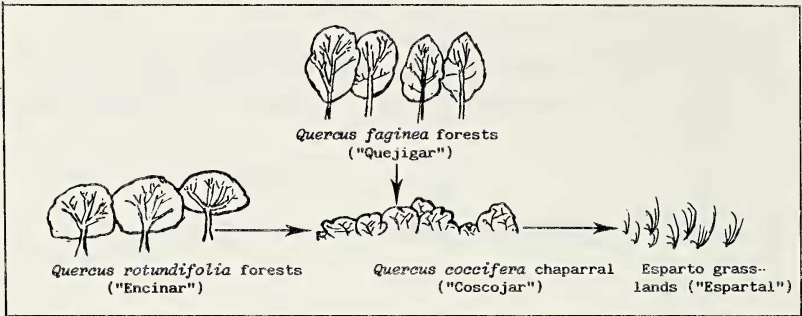


Fig. 2. Dynamism of the plant communities in the Tagus Valley.

habitats of the Tagus Valley are given in Table 1. In addition, ruderal communities, resulting from direct human impact such as those associated with farmlands, occur in the area. And, finally riparian communities exist limited to the immediate borders of river banks.

The general intensive degradation of the local vegetational communities resulting from agricultural and industrial activities have made woodlands rare while shrub steppes abound. Agricultural landscapes, mainly cereal fields, olive groves, orchards and vineyards predominate.

This study is based on a sample of nearly 6000 butterflies and skippers (Papilionoidea and Hesperioidea), captured during the period 1975-1983, in 79 localities throughout the Tagus Valley (Viejo, 1983). At least four sampling localities with each of seven vegetational communities were sampled. As far as the work itself is concerned, we have established these seven vegetational communities to include: "Encinares" (*Quercus rotundifolia* forests), "quejigares" (*Quercus faginea* forests), "coscojares" (*Quercus coccifera* chaparral), "espartales" (esparto grasslands), "secanos" (dry croplands), "riberas" (riparian forests) and "regadíos" (irrigated croplands).

A diversity index at each sampling site has been done using Shannon-Weaver's coefficient (Margalef, 1957):

$$H = - \sum p_i \log_2 p_i$$

Where H is Diversity; $p_i = N_i/N$; N_i = number of species i ; and N = specimen numbers.

Results

Table 2 gives the Tagus Valley butterfly and skipper species list, with the number of species and the diversity of the two richest localities from each vegetational community. The highest number and diversity of species occurs on "quejigares" (Figs. 3 & 4). At one of these locations, Pioz, almost 30% of the Iberian species occur. The "quejigares" oak

Table 1. Dominant floral elements in the major natural habitats of the Tagus Valley. C. D.: Conservation Degree, according to Van Maarel's classification (1975).

"ENCINARES" (<i>Quercus rotundifolia</i> forests)	"COSCOJARES" (<i>Quercus coccifera</i> chaparral)	"QUEJIGARES" (<i>Quercus faginea</i> forests)	"ESPARTALES" Esparto grasslands	"RIBERAS" (Riparian forests)
<i>Quercus rotundifolia</i>	<i>Quercus coccifera</i>	<i>Quercus faginea</i>	<i>Stipa tenacissima</i>	<i>Ulmus minor</i>
<i>Rhamnus alaternus</i>	<i>Rhamnus lycioides</i>	<i>Rosa micrantha</i>	<i>Asphodelus albus</i>	<i>Populus canescens</i>
<i>Ruscus aculeatus</i>	<i>Jasminum fruticans</i>	<i>Crataegus monogyna</i>	<i>Rosmarinus officinalis</i>	<i>Populus nigra</i>
<i>Crataegus monogyna</i>	<i>Ephedra major</i>	<i>Arctostafyllos uva-ursi</i>	<i>Genista scorpius</i>	<i>Arum italicum</i>
<i>Genista scorpius</i>	<i>Rosmarinus officinalis</i>	<i>Lavandula latifolia</i>	<i>Arrhenatherum erianthum</i>	<i>Scirpus holoschoenus</i>
<i>Juniperus oxycedrus</i>	<i>Thymus vulgaris</i>	<i>Thymus vulgaris</i>	<i>Avena bromoides</i>	<i>Conium maculatum</i>
<i>Rubia perigrina</i>	<i>Genista scorpius</i>	<i>Genista scorpius</i>	<i>Dactylis hispanica</i>	<i>Brachypodium phoenicoides</i>
<i>Lonicera etrusca</i>	<i>Asphodelus ramosus</i>	<i>Colutea arborescens</i>	<i>Bupleurum frutescens</i>	
<i>Daphne gnidium</i>	<i>Bupleurum frutescens</i>	<i>Cephalanthera alba</i>		
<i>Cistus ladanifer</i>	<i>Viola wilkommii</i>	<i>Colutea arborescens</i>		
C.D.: Semi-Natural	C.D.: Semi-Natural	C.D.: Natural	C.D.: Agricultural	C.D.: Agricultural

forests produce the highest diversities of all sampled localities in this region.

The selected "coscojares" (*Quercus coccifera* chaparral) also are comparatively rich, including the well-known localities at Aranjuez and Campo Real. The former is a "coscojar" (evergreen oak forest), and the second a mixed "coscojares-quejigo" forest (Fig. 2).

The evergreen oak forests show more moderate species richness, although less than the one might *a priori* predict, from the climatic nature in the Tagus Valley.

Noteworthy also is the greater richness of the dry croplands ("secano") in comparison to the "espartales", theoretical second replacement stage of the climatic forest (Fig. 2).

Riparian habitats also exhibit reduced richness than might be expected for a climax vegetational community.

Finally, note that the most impoverished localities are the irrigated croplands (regadío).

Discussion

Quejigo forests clearly present the richest butterfly and skipper faunas in the Tagus Valley. This is probably related to the superior conservation status, that is, less disturbed nature of these plant communities (Tem-

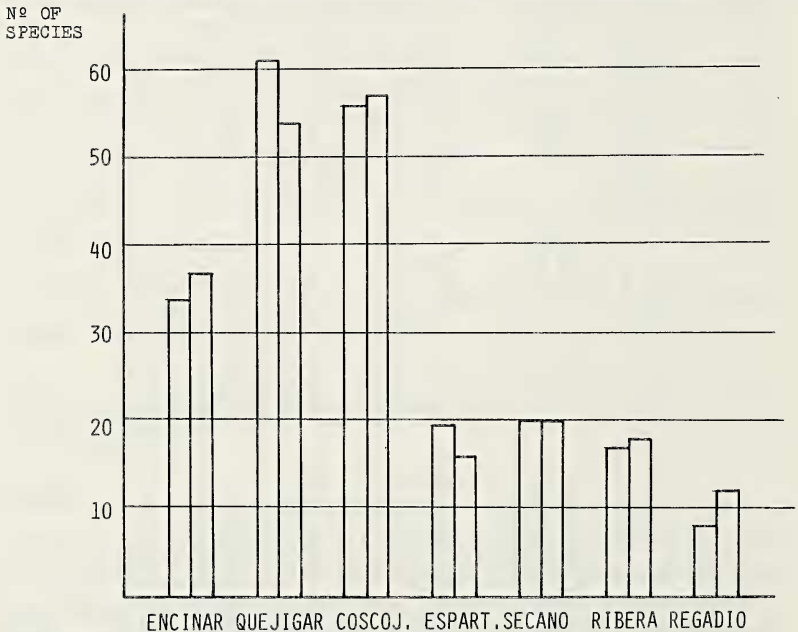


Fig. 3. Number of species of the two richest localities of each landscape.

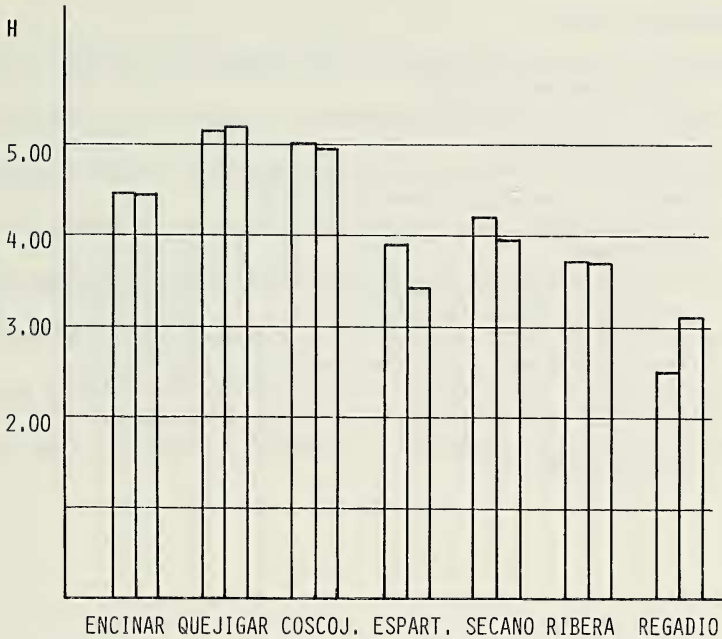


Fig. 4. Diversity of species of the two richest localities of each landscape.

plado, 1982; Lawton, 1983). Thus these mediterranean oak forest should be considered the highest conservation priority in the Tagus Valley.

The "coscojares" also have a high faunal richness, close to that of the "quejigares". This may be attributed to the relative structural similarity of these shrublands with the climax woodlands, since they only vary by the elimination of the tree layer of evergreen oaks or "quejigos". This shortened evergreen oak forest richness, slightly less than that of the autoctonous woodland is the result of intensive habitat disturbance where the shrub layer has been considerably altered and/or destroyed by man.

Dry croplands maintain a surprising faunal richness largely produced by the presence of marginal plant communities, particularly weeds typical to olive groves, vineyards, etc. This vegetation ("arvens") supports a substantial butterfly and skipper community.

River margins are extremely degraded in the Tagus Valley, especially the shrub component of the community, thus their faunas are impoverished.

Irrigated croplands are the very poorest habitats for butterflies and skippers. These areas are subject to the most drastic alteration through irrigation, the use of pesticides and herbicides, and other agricultural activities.

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